



Windbreak Renovation

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Windbreaks are an integral part of many farms and ranches and provide critical protection for farmsteads, livestock and crops. Unfortunately, many windbreaks planted in the 1930s and 1940s are losing their effectiveness due to age, poor health or neglect. In some cases, the windbreak no longer has the necessary density to provide winter protection. In other cases, overcrowding may have reduced the health and vigor of the windbreak, or the windbreak may have been invaded by aggressive sod-forming grasses such as smooth brome, reducing tree growth. Whatever the reason, many older windbreaks need renovation.

All windbreaks, even well-designed ones, need regular maintenance in order to maintain their overall structure and to continue to function as effective wind barriers. While maintenance should be done throughout the life of the windbreak, windbreak renovation is usually restricted to older or neglected windbreaks.

There are many techniques available. This guide is designed to provide a step-by-step approach for restoring the effectiveness of your windbreak. With careful planning and follow-through, renovation of your windbreak should lead to the development of a healthy and functional windbreak.



Three rows of eastern redcedar were added to this farmstead windbreak providing protection from blowing snow. In several more years the remaining rows of Siberian elm should be removed and replaced with two or more rows of tall, deciduous trees such as green ash, hackberry or oak.



Where to Begin?

Assuming that you have decided you have a problem with your windbreak, there are three questions you need to answer before you begin a renovation project. What are the objectives of your windbreak planting? What is the condition of your windbreak? What techniques could you use to reach your objectives?

Several definitions may be helpful as you use this guide to assess the condition of your windbreak. **Density** refers to the amount of solid material in the windbreak. We refer to the overall amount and arrangement of that solid material within the windbreak as the **structure** of a windbreak. **Sod-forming grasses** are aggressive grass species such as smooth brome, Kentucky bluegrass, or quackgrass, which rob trees and shrubs of water and nutrients. The **understory** refers to those plants growing under the windbreak, typically shrubs or small trees.

What are your objectives? What is the primary purpose of your windbreak? Does your windbreak still meet that objective? Windbreaks designed for snow distribution, wind erosion control or farmstead protec-



Tree removal from within a windbreak can be labor intensive and mechanical methods should be used when possible. Be careful to avoid damage to the remaining trees within the windbreak.



M. Harrell

Cercospora needle blight is a serious problem in Juniper windbreaks. Annual observations of your windbreak will help you identify any problems and allow for treatment before they become severe.

tion have different design requirements and require different renovation techniques. In addition to your primary objectives, determine any secondary benefits you want in your windbreak. Is snow management a concern? Do you want to attract more wildlife? Consider your overall farm or ranch operation. Is the original design still meeting your needs? Is the windbreak located in the right place? Remember that the windbreak that will result from your efforts could be there for the next 50 years. Clearly identifying your objectives is important because it will help you determine the best species, the best design and the optimal location for the windbreak.

What is the condition of your windbreak? Walk through your windbreak and determine the overall tree health. Are there dead or dying trees? Are there insects, diseases or other problems that should be addressed? Are there gaps in the windbreak? Does the windbreak provide enough wind protection to meet your needs?

What techniques are available? If your windbreak is a one- or two-row field windbreak, go to the **Field Windbreak Key**. For multiple-row, farmstead or livestock windbreaks, go to the **Farmstead or Livestock Key**. Read each statement or question in a group and select the one that best fits your situation. Each statement refers you to another group of statements or to a renovation technique (RT). Repeat the process for each new group of statements. Try to identify those features that apply to your windbreak and review the techniques that help you meet your objectives.

Field Windbreak Key

1. The windbreak forms a complete barrier with no gaps; trees appear healthy and vigorous with few dead branches and no insect or disease problems. No noxious weeds or sod-forming grasses are present. The windbreak is meeting all of your objectives. No renovation is needed, continue your annual maintenance program.
1. The windbreak appears unhealthy; trees may be overcrowded or protection is not adequate; individual trees are in poor condition with many dead branches. Noxious weeds or sod-forming grasses may be present. Overall the windbreak fails to meet your objectives. Go to 2.
2. Sod-forming grasses or noxious weeds are present. See Renovation Technique 1.
2. Sod-forming grasses or noxious weeds are not present. Go to 3.
3. Individual trees in the windbreak appear healthy but there are large gaps (two or more adjacent trees are missing) in the windbreak. See Renovation Technique 2.
3. There are no large gaps in the windbreak. Go to 4.
4. The density of the windbreak is low (less than 30 percent), especially in the lower one-third. The windbreak fails to provide sufficient wind erosion control or crop protection. See Renovation Technique 3.
4. The density of the windbreak is high (more than 50 percent) and there is adequate wind erosion control. However, deep snow drifts form that restrict field access in the spring. See Renovation Technique 4.
4. The density is about right to meet your objectives but there are problems not identified above. Go to 5.
5. Individual trees have insects or diseases present. Contact a local tree care professional to determine the insect or disease present and the proper treatment. Treat only if necessary.
5. Windbreaks are in good condition and meet your primary objectives but you would like to see more wildlife. Consider adding a shrub row or leaving several rows of unharvested crop adjacent to the windbreak for wildlife. See EC-91-1771, *Windbreaks and Wildlife*, for additional ideas.
5. Windbreaks are in good condition but crop yields next to the windbreak are low. See Renovation Technique 5.
5. Windbreaks are in good condition, but they are over 30 years old and it is time to plan for the future. See Renovation Technique 6.

Farmstead and Livestock Windbreak Key

1. The windbreak appears healthy and vigorous with few dead branches and no insect or disease problems. The trees are well spaced within rows and between rows. There are no gaps in the overall windbreak. No aggressive sod-forming grasses or noxious weeds are present. Go to 2.
2. There is a good mix of deciduous and coniferous tree and shrub species; trees are of several ages. No renovation is needed, continue your annual maintenance program.
2. Windbreak is composed of a single species and all trees are approximately the same age. See Renovation Technique 7.
1. The windbreak appears unhealthy; individual trees are in poor condition; density may be too low or too high to meet your objectives. Go to 3.
3. Sod-forming grasses or noxious weeds are present. See Renovation Technique 1.
3. Sod-forming grasses or noxious weeds are not present. Go to 4.
4. Insects or diseases are present. Contact a local tree-care professional to determine the insect or disease present and the necessary treatment. Treat only if necessary.
4. Insects or diseases are not present. Go to 5.
5. Trees are overcrowded. See Renovation Technique 8.
5. Trees are not overcrowded; density is low and wind protection is limited. See Renovation Technique 9.

Renovation Techniques

Renovation Technique 1. Competing vegetation, especially aggressive sod-forming grasses, rob trees and shrubs of moisture and nutrients. A general rule of thumb is that if 50 percent or more of the undergrowth vegetation is made up of perennial grasses and broadleaved weeds, chemical weed control is recommended. Mechanical weed control or cultivation can spread rhizomes of these plants and increase competition. Cultivation can be difficult between established tree rows. If tillage is used, avoid tilling deeper than two to three inches to prevent injury to tree roots.

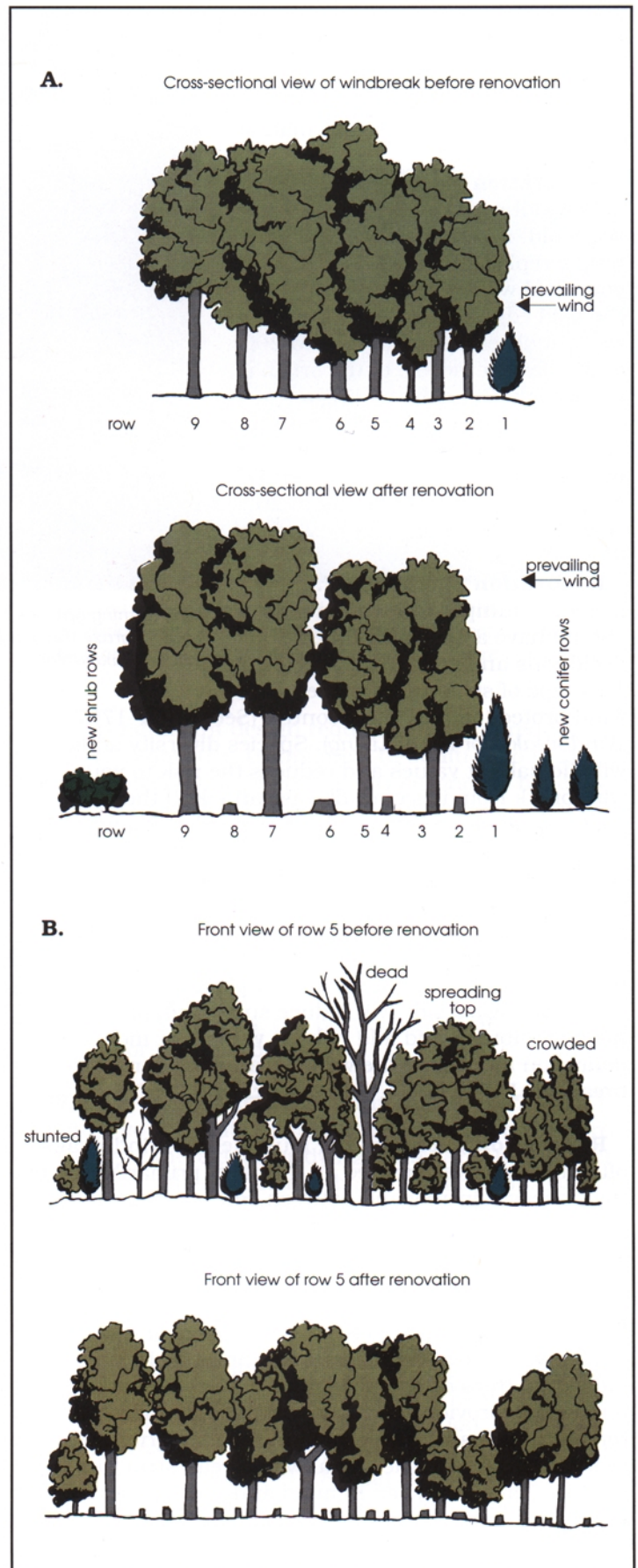
Renovation Technique 2. Gaps in a field windbreak allow wind to flow through the gap, creating an area of increased wind speed on the leeward side of the gap. Large gaps decrease the degree of protection and may result in wind erosion, crop damage and reduced yields. For windbreaks less than 10 years old, gaps may be filled by transplanting small trees into the gap at minimum expense. For windbreaks more than 10 years old, larger trees may be required and most likely will require the use of a tree spade. In both cases, good weed control is required. Mulching with four to six

inches of wood chips is one of the best ways to control weeds and promote rapid root growth. Larger trees should be staked and will generally require supplemental water for several years, especially in arid and semi-arid regions.

Renovation Technique 3. Field windbreaks with low density in the understory fail to control wind erosion and offer poor wildlife habitat. Often this lack of density is caused by livestock grazing. If winter grazing of crop stubble is a common practice, your windbreaks should be fenced during the grazing period. A single strand of electric fence is the cheapest and most convenient way to protect your windbreak while grazing crop fields. Interplanting a low-growing shrub will add both density and plant diversity and improve wildlife habitat. In areas where snow distribution is a major goal, increasing low density will lead to larger snow drifts and may limit spring access to the field area adjacent to the trees. Planting alfalfa in the snow drift area uses the moisture from the snow while eliminating the problems associated with spring access.

Renovation Technique 4. Field windbreaks often are planted at a close spacing in order to get good wind protection early in the life of the windbreak. Field windbreaks with a winter density greater than 50 percent provide excellent wind erosion control in the spring but reduce snow distribution patterns across the field. In more northern areas, these drifts may limit spring access. One option to reduce density is to selectively remove individual trees and/or understory vegetation. A general rule of thumb is that if more than 50 percent of the tree is dead, it is a good candidate for removal. Removing dead wood removes potential disease and insect brood sites. Suppressed trees contribute little to the windbreak in height or density and are also good candidates for removal. Pruning lower tree branches is also a common practice for lowering density. Caution must be taken so that the integrity of the windbreak is maintained and protection is not diminished. Do not prune above four feet, or crop-protection benefits may be lost. Planting a perennial forage crop in the area adjacent to the windbreak eliminates the need for early spring access and reduces annual input costs.

Renovation Technique 5. Field windbreaks in good condition protect crops growing in the lee of the windbreak. In the area adjacent to the windbreak there are often depressed yields due to competition between the crop and the trees for moisture and nutrients and due to the shade created by the windbreak. Economic analyses indicate that in general, and for most tree species, the yield benefits from field windbreaks within the protected zone (2 to 15 H downwind, where H is the height of the windbreak) more than compensate for the yield losses in the competition zone. Cottonwood, Siberian elm and Osage orange are three exceptions to this general rule. For these species, and in arid areas, the technique of root pruning is a useful tool to reduce competition between the windbreak and the crop. Pulling a 24- to 36-inch vertical blade through the soil at the drip line of the windbreak will sever tree roots



Typical multi-row windbreak before and five years after renovation.
 A. Cross-sectional view from the end.
 B. Front view of Row 5 showing trees within the row.

that are competing with the crop. The practice is only temporary and needs to be repeated every three to five years. See EC-99-1765, *Field Windbreaks*, for further information.

Renovation Technique 6. If the field windbreak is more than 30 years old, it is time to begin planning a replacement windbreak. If your field windbreak is located on the field edge, consider locating a new windbreak parallel to, and 200 to 300 feet to the lee, of the original windbreak. Consider adding a second windbreak, locating it 15 to 20 H to the lee of the first new windbreak, where H is the potential height of the new windbreak in 20 years.

Renovation Technique 7. In general, multiple-row windbreaks should have a good mix of both deciduous and coniferous species. This type of structure provides good wind protection and snow control (See EC-91-1767, *Windbreaks for Rural Living*). Species diversity adds wildlife habitat values and reduces the risk to your windbreak from insect or disease attack. If there is space available, you may wish to consider adding several rows of different species. For example, the wildlife habitat value of a three-row eastern redcedar windbreak can be increased by adding a row of shrubs to the leeward side. Locate the new row outside of the zone where snow drifts may form. If snow drifts are a problem in your area, a shrub row placed 50 to 100 feet to the windward side will reduce snow drifts in the main windbreak and add habitat value. For more details on increasing the wildlife value of your windbreak see EC-91-1771, *Windbreaks and Wildlife*.

Renovation Technique 8. Multiple-row windbreaks often become overcrowded as they age, primarily due to the close within-row and between-row spacings at the time of planting. Natural regeneration and improper species selection can contribute to overcrowded conditions. As a result, growth of individual trees within the windbreak is reduced, and the increased stress from competition can predispose trees to insect or disease attack. Where overcrowding is a serious problem, individual trees or complete rows of trees should be removed to provide adequate growing space for the remaining trees while maintaining the integrity of the overall windbreak. The overall windbreak structure is the key element to keep in mind and not the form of individual trees.

Selecting trees or tree rows for removal depends on the condition of the windbreak and may require the assistance of a professional forester. There are three basic levels of tree removal from a windbreak: 1. Complete removal of the windbreak; 2. Removal of complete rows; and 3. Thinning or removal of individual trees.



USDA-NRCS

Sod-forming grasses have seriously slowed tree growth within this windbreak. Resist the urge to graze the windbreak. Control the grass with herbicide and mulch the pine with wood chips if available.

1. Complete Removal — The most drastic form of windbreak renovation is complete removal and replacement. This technique exposes the previously protected area to potential wind damage from the time of removal until new trees have grown large enough to provide an effective barrier — possibly 10 to 15 years. The advantage of this method is that it allows repositioning of an improperly located windbreak.

2. Removal of Rows — Older windbreaks tend to have rows that are close together. In some cases incompatible species, such as a slow-growing conifer and a fast-growing deciduous species, were planted in adjacent rows. Removing rows of overtopped or mostly dead trees helps stimulate growth and increase the vigor of the remaining trees, resulting in increased foliage density in the middle and upper levels of the windbreak. Rows may be removed from either the outside edge or from the interior. Which rows to remove is determined by the condition of the windbreak and the structure of individual tree rows.

If the windbreak is composed entirely of old, large deciduous trees, the most pressing need is to add lower density. In this case, removing three or four outside rows on the windward side and replacing them with two rows of conifers is usually a good approach. Plant the new rows between the old rows.

Removing rows on the leeward side can provide space for wildlife plantings or landscaping. Planting on the leeward side requires that there be enough density to the windward side to control blowing snow. If not, large drifts may form in undesirable areas. If room is available, a trip row of shrubs can be planted on the windward side.



J. Wilson

Planting several rows of trees within an existing windbreak is one method to increase windbreak density. Using a fabric mulch to control competing vegetation increases tree growth and reduces the amount of labor required.

Removing interior tree rows can provide additional growing space for adjacent rows or planting space for replacement rows. As a general rule, one row of new trees can be planted for every two rows removed. Species selected for replanting should complement species that remain from the original planting and should be able to grow in the shady environment of the windbreak interior. Competition from the adjacent tree rows can be reduced by root pruning.

3. Thinning or Removal of Individual Trees — The unseasonable loss of foliage color, leaves or needles, the thinning of the crowns, or the presence of insect or disease problems may all be symptoms of overcrowding. Removing weaker trees with these characteristics helps strengthen remaining trees. The extent of tree removal during renovation is a function of the number of rows present, the spacing within and between rows, and the overall vigor of the trees. At the very least, remove trees with insect or disease problems, poorly formed trees or trees with thin crowns. Dead trees may be removed as well, but if the presence of wildlife is desired, dead trees make excellent habitat for woodpeckers and cavity nesters and consideration should be given to leaving several snags per acre. Remember, it is the overall structure of the windbreak that is important, and not the shape or growth rate of individual trees.

In overcrowded rows where trees appear reasonably healthy, one option is to remove every other tree within the row. Alternatively, remove only large, deciduous trees to stimulate growth of the easily suppressed conifers. Before removing healthy trees to relieve crowding, consider the longevity and desirability of each

species, the current conditions of the various plants, and the ability of the remaining trees to respond to the improved growing conditions.

Renovation Technique 9. Adding density to an existing windbreak can be done by a number of methods:

Interplanting. Planting trees and shrubs into open areas or gaps is important for future windbreak protection and should be done on a regular basis as openings occur. Interplanting with several tree species will increase diversity. Complement replanting by allowing new young trees that may occur naturally to grow.

Coppice or Regrowth Management.

After thinning tree rows, many deciduous tree species will resprout from the stump. This type of growth is known as

coppice growth and has several advantages. The resprouts tend to grow faster than transplanted seedlings because they have an established root system and can withstand some competition. One problem with coppice management is that the regrowth may not live as long as the original tree.

Shrub Row Rejuvenation. Shrub rows that are tall and leggy may be rejuvenated by cutting the stems to a 6-to 8-inch height. This is best done during the dormant season. Rejuvenation stimulates the sprouting of multiple buds and provides low density to the windbreak. For large gaps in the shrub row, add new plants, preferably a different shrub species.

Management of Natural Regeneration. Young woody seedlings may be found in many windbreaks and can be managed to improve windbreak density. These seedlings do not always grow in rows, so it can be difficult to determine which seedlings to leave. If we look at the windbreak as a mini-forest, natural regeneration can be gradually thinned and managed to maintain a uniform windbreak.

Additional Information and Assistance

Renovating a windbreak is a difficult task. Help in assessing your windbreak and determining the best renovation techniques is available from your local forester, district conservationist or extension educator. When using herbicides be sure to read and follow label instructions.